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The Importance of Teachers' Emotions and Instructional Behavior for Their Students' Emotions – An Experience Sampling Analysis

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The Importance of Teachers' Emotions and Instructional Behavior for Their Students' Emotions – An Experience Sampling Analysis

Abstract

The present study focuses on the relationship between teachers' emotions, their instructional behavior, and students' emotions in class. 149 students (55% female, Mage = 15.63 years) rated their teachers' emotions (joy, anger, anxiety) and instructional behavior, as well as their own emotions in an experience-sampling study across an average of 15 lessons in four different subject domains. Intraindividual, multilevel regression analyses revealed that perceived teachers' emotions and instructional behavior significantly predicted students' emotions. Results suggest that teachers' emotions are as important for students' emotions as teachers' instructional behavior. Theoretical implications for crossover theory and practical recommendations for teachers are discussed.

Keywords: Crossover Theory, Emotional Contagion, Teacher Emotion, Experience Sampling, Intraindividual Approach, Multilevel Analysis

Highlights:

- Teachers' emotions are an important predictor of students' emotions in class
- Teachers' emotions and instructional behavior in class are of comparable importance
- Structural relations were consistent across four different school domains
- Students' mood shapes how teachers' emotions and instructions are perceived

Introduction

"I have come to a frightening conclusion. I am the decisive element in the classroom. It is my personal approach that creates the climate. It is my daily mood that makes the weather (...)." (Ginott, 1976, Teacher and Psychologist).

Students spend a significant amount of time in the classroom – an interactive setting which is full of emotions. Emotions are an important outcome as they are an integral part of personal well-being (e.g., Pekrun, Goetz, Titz, & Perry, 2002; Schimmack, 2008) and also predict important learning and career related outcomes, including learning strategies (e.g., Goetz, Zirngibl, Pekrun, & Hall, 2003), academic achievement (Pekrun et al., 2002; Valiente, Swanson, & Eisenberg, 2012) and future career choices (e.g., Wigfield, Battle, Keller, & Eccles, 2002). In his book "Teacher & Child" Haim G. Ginnot pointed out the power that teachers' emotions and moods have on their students and the whole class climate. This was almost 40 years ago – but until today, there is little empirical support for his assumption, an issue that can be attributed to a lack of research on teachers' emotions. Historically, teaching was primarily viewed as a predominately cognitive activity with research focusing on teachers' thoughts and beliefs, teaching skills, and their pedagogical and content knowledge (e.g., Frenzel, Goetz, & Pekrun, 2008; Hargreaves & Tucker, 1991). Furthermore, emotions were considered as elusive constructs that were difficult to measure reliably and also a rather "feminine" issue, therefore not a worthwhile research topic (Zembylas, 2003, p. 106).

Fortunately, over the past decade, scholars have started to acknowledge the importance of investigating the impact of the emotional dimension of teaching on student outcomes (e.g., Baumert & Kunter, 2006; Demetriou, Wilson, & Winterbottom, 2009; Zembylas, 2005). For instance, Hargreaves (1998) stated that the emotional dimension is "one of the most fundamental aspects of teaching" (p. 835) and a study by Baird and colleagues (Baird, Gunstone, Penna, Fensham, & White, 1990) revealed the importance of a balance between affect and cognition for effective teaching and learning in undergraduate science courses. Nevertheless, empirical support for the relationship between teachers' and students' emotions is scarce.

The goal of the present study is to address this gap in the literature by examining the strength of the relationship between teachers' emotions and students' emotions. Based on findings from the crossover theory, which posits that emotions can be elicited directly or indirectly from the emotions of others (Härtel & Page, 2009), it is hypothesized that teachers' and students' emotions are interrelated. To investigate the importance of the emotional dimension of teaching on students' emotions, we compared the strength of the relationship between teachers' emotions and teachers' instructional behavior on students' emotions.

Given that our research interests relate to intraindividual functioning (i.e., how teachers' emotions and instructional behavior influence one students' emotions in specific lessons), we adopted an experience-sampling method, an approach with several unique advantages. First, prior research demonstrates that one-time, recall-based ratings (i.e., self-reports) of emotions have limited validity as these approaches are often contaminated by, for example recall inaccuracies, cognitive and memory limitations (Carson, Weiss, & Templin, 2010; Robinson & Clore, 2002), and can be influenced by personality (e.g., neuroticism and extraversion can influence retrospective ratings of emotions, see Barrett, 1997) or subjective beliefs (Goetz, Bieg, Lüdtke, Pekrun, & Hall, 2013). Experience-sampling procedures are less vulnerable to biases, especially recall inaccuracies, as they measure emotions directly in the situations that they arise in and evaluate *actual* emotions rather than *beliefs* about emotions. Second, one-time examinations of emotions usually focus on relatively stable habitual emotions (i.e., trait-based emotions) and gauge the "overall emotional tone" in a classroom (Frenzel, Goetz, Lüdtke, Pekrun, & Sutton, 2009, p. 712), but they are not capable of assessing micro-processes that are at work when it comes to emotional crossover. Conversely, experience-sampling methods can account for the dynamic nature of certain emotions that vary according to situational factors (i.e., state-based emotions). Finally, experience-sampling approaches produces data of greater ecological validity than self-report based approaches as constructs are assessed within their natural occurring context (i.e., "in-situ assessment" or "ecological momentary assessment", see Carson et al., 2010).

Emotional Crossover

It is well known that emotions and other psychological states are contagious; in fact there is a whole body of research that looks at this specific phenomenon. This idea that humans "catch" psychological states of others with whom they interact has been described from various theoretical perspectives in social psychology, neuroscience, communication research, and industrial-organizational psychology often in the context of emotional contagion or crossover theory. Emotional contagion refers to the "tendency to automatically mimic and synchronize facial expressions, vocalizations, postures, and movements with those of another person and, consequently, to converge emotionally'' (Hatfield, Cacioppo, & Rapson, 1994, p. 5). In contrast, crossover theory is a broader approach that includes the crossover of emotions, but also other psychological constructs. As such, emotional contagion is an explanatory mechanism for the transmission of experiences between interaction partners within crossover theory, in addition to other, more conscious processes.

In its original conceptualization, crossover theory focused on crossover effects of work-related stress and strain (Bolger, DeLongis, Kessler, & Wethington, 1989). More recently, this theory was expanded to include positive and negative feelings and states such as depression, well-being, flow, burnout (e.g., Bakker, 2005; Westman, 2001), and further refinements by Härtel and Page (2009) incorporate discrete emotions such as anger and joy. The majority of studies in the crossover literature focus on employee well-being, stress, and burnout; however the academic context has largely been overlooked. To our knowledge, only two studies have investigated emotional crossover processes in academic settings. First, Bakker (2005) examined the crossover of flow experiences between music teachers ($N = 178$) and their students ($N = 605$) in a questionnaire based study. Specifically, he found a significant relationship between teacher's and student's reported flow experiences (consisting of three dimensions: absorption, work enjoyment, and intrinsic work motivation) in music classes. Bakker concludes that the mechanisms for flow crossover are both conscious and unconscious and recommends that since students tend to automatically imitate their cheerful and happy teacher (direct, unconscious crossover), work enjoyment may be transferred through emotional contagion. Moreover, he states that teachers, who are motivated, tend to put more effort and energy into their lessons, which in turn leads students to recognize their teacher's dedication to their work and consequently promotes student motivation (indirect, conscious crossover). The second study, by Frenzel and colleagues (Frenzel, Goetz, Lüdtke, et al., 2009) examined emotional transmission (i.e., emotional crossover processes) between teachers and students in mathematics classes. A sample of 1542 students from 71 classes reported their emotions in class and their teacher's enthusiasm at two time points (grades 7 and 8), and teacher reports of their emotions in class were available for the second time point. The authors employed a value-added design (for more information on this technique, see e.g., Seidel & Shavelson, 2007) by exploring the relationship between teachers' emotions and students' emotions in grade 8 while controlling for important prerequisites (i.e., students emotions one year earlier). The study showed that teachers' and students' enjoyment in mathematic classes were significantly related, with teacher enthusiasm partially mediating this relationship. Teacher enthusiasm is regarded as a behavioral aspect of enjoyment during teaching that enables students' to perceive their teachers' enjoyment.

Although these studies contribute to the emotional crossover literature by bringing it into academic settings and offering important new insights on possible underlying mechanisms in the crossover process, they are not without their limitations. Most importantly, they used trait-based self-reports. As such, they assessed more general, retrospective estimations of emotional experiences. As previously mentioned, this methodological approach captures the overall "emotional tone" of classrooms (Frenzel, Goetz, Lüdtke, et al., 2009), but is prone to retrospective biases (Carson et al., 2010) and tends to reflect evaluations or beliefs about ones emotions (Goetz, Bieg, et al., 2013; Härtel & Page, 2009; Robinson & Clore, 2002) rather than the actual emotion. The goal of the present study is to examine interactive processes in the classroom with an experience-sampling methodology; a more fine-grained approach that considers that emotions fluctuate based on specific situations and allows for intraindividual analyses.

Mechanisms of the Crossover-Process

There are four mechanisms for the emotional crossover phenomenon that have been proposed in the literature (besides the possibility that crossover is a spurious effect, because the interaction partners are sharing the same social environment, see Westman & Vinokur, 1998). Three mechanisms have been proposed in crossover literature and one mechanism has been discussed solely in emotional contagion research so far. First, emotional crossover could occur directly through a *primitive emotional contagion* as proposed by Elaine Hatfield and colleagues (1994). Accordingly, emotions between interaction partners converge as a result of unconscious, emotive processes that follow a two-step mimicry process. In the first step, one person imitates another person's expression and nonverbal cues. In the second step, these imitations act as afferent feedback and result in corresponding emotions (Hennig-Thurau, Groth, Paul, & Gremler, 2006). Empirical findings suggest that (perceived) teachers' and students' emotional responses (pleasure, arousal, and dominance) in university classes are significantly related and that these relationships can be partially explained by convergent nonverbal behavior (Mottet & Beebe, 2000). Specifically, 23% of the variance in student nonverbal behavior was explained by their teacher's nonverbal behavior, with student nonverbal behavior being related to students' emotional responses. However, given that the study used a one-time examination and included only students' self-reports, the explanatory power is limited.

Westman and Vinokur (1998) proposed a second direct crossover mechanism which suggests that empathy on behalf of the receiver could explain crossover processes. Since interaction partners usually know each other well, sympathetic reactions can result in a transmission of emotions, well-being, or stress. A third mechanism in crossover processes is *conscious emotional contagion* (e.g., Barsade, 2002; Hennig-Thurau et al., 2006) sometimes referred to as *emotional comparison* (Sullins, 1991). This concept has been studied in the context of emotional contagion but to date, has not been integrated into crossover theory. Conscious emotional contagion involves actively searching for emotions to gain social information, a process that occurs especially in ambiguous situations. For example, people who are in an opera for the first time and do not know what behaviors or emotions are appropriate might observe another person's emotional displays and use them as cues for their own behavior. Although a reasonable explanation, we do not expect that this mechanism applies to crossover processes between teachers and students in class as they frequently interact with each other and conscious emotional contagion likely plays a more significant role in first interactions.

Finally, the crossover phenomenon could occur indirectly with mediators underlying the process (Westman, 2001). The specific mediating variables depend on the outcome variable that is studied in the crossover process. For example, Westman and colleagues (2004) investigated social exchange style (social undermining) as a potential mediator of the crossover process of marital dissatisfaction, whereas Neff and colleagues (Neff, Sonnentag, Niessen, & Unger, 2012) suggested that the crossover of job-related self-esteem is mediated by social comparison processes. In an academic context, instructional behavior could act as a mediating variable between teachers' and students' emotions. This assumption stems from the *model of reciprocal causation between teacher emotions, instructional behavior, and student outcomes* proposed by Frenzel and colleagues (Frenzel, Goetz, Stephens, & Jacob, 2009). This model posits that teachers' emotions have a reciprocal influence on their instructional behavior (i.e., cognitive stimulation, motivational stimulation, and social support), which in turn influences student outcomes (i.e., competence level, motivation, and social-emotional skills). In a questionnaire-based study with 1762 students drawn from 71 mathematics classes and the corresponding teachers, the authors offered support for the link between teachers' emotions and their instructional behavior. Teachers who reported more positive emotions were more likely to provide adequate examples, to give more clear and comprehensible explanations, to make more connections between the subject matter and real word, and to teach with greater enthusiasm. Conversely, teachers who experienced more negative emotions such as anger or anxiety were less likely to show this beneficial instructional behavior. Other empirical findings pertaining to the relationship between teachers' emotions and their instructional behavior are scarce and often focus only on teachers' own estimations (e.g., Sutton, 2004, 2007) or on broader concepts such as general enthusiasm rather than discrete emotions (Kunter et al., 2008).

The link between instructional behavior and students' emotions is supported theoretically and by a few recent empirical studies. Theoretically, instructional behavior should influence students' emotions as they directly impact control and value appraisals, which have been shown to be important precursors of students' emotions (e.g., Ahmed, van der Werf, & Minnaert, 2010; Bieg, Goetz, & Hubbard, 2013; Goetz, Frenzel, Stoeger, & Hall, 2010; Pekrun, 2006). By using clear and comprehensible explanations, teachers can promote students' control appraisals (i.e., students' expectations that their scholastic aptitudes will lead to success outcomes). Furthermore by connecting the subject matter to real world situations and by teaching enthusiastically, teachers can enhance students' value appraisals (i.e., students' judgments of the utility or the relevance of the domain, activities, and outcomes). Empirical findings in this area show that teacher enthusiasm is related to student enjoyment in class (Frenzel, Goetz, Lüdtke, et al., 2009) and that teaching characteristics related to a *supportive presentation style* (e.g., understandability, illustration, enthusiasm) and *excessive lesson demands* (difficulty, level of expectation, pace) relate to student academic emotions (enjoyment, pride, anxiety, anger, helplessness and boredom) in class across four different subject domains (Goetz, Lüdtke, Nett, Keller, & Lipnevich, 2013).

Based on these assumptions, we propose that emotional crossover in the classroom is partially explained by the mediating role of instructional quality. We only expect a partial mediation as teacher emotions also directly cross over through emotional contagion and sympathetic reactions such as empathy. Thus, we expect an incremental impact of teachers' emotions on students' emotions above and beyond teachers' instructional behavior.

The Present Study

The current study contributes to the literature in several ways. First, the majority of studies on emotional crossover processes to date have been conducted in non-academic / non-instructional settings. Second, prior studies relied on trait-measures, and thus have clear limitations. Furthermore, few studies have focused on discrete emotions and, to our knowledge, none have adopted an intraindiviual approach (i.e., experience-sampling).
Our study investigates three hypotheses:

Hypothesis 1: Teachers' discrete emotions relate to students' discrete emotions in class.

Our first objective was to show that students' perceptions of teachers' emotions were related to their own self-reported emotions, a finding that we expected for both positive and negative emotional experiences. Emotions in the current study were examined based on three criteria: First, we wanted to assess emotions that are conceptually distinct, therefore we used Watson and Tellegen's (1985) categorization of emotions proposed in the circumplex model, which organizes emotions according to activation and valence. Second, we selected emotions that were considered to be important and common among teachers (see review by Sutton & Wheatley, 2003). Finally, we only considered basic emotions that were easy to detect for observers based on prototypical expressions (see e.g. Ortony & Turner, 1990) because teachers' emotions were assessed via students' perceptions in this study. As such, we assessed enjoyment (a positive, activating emotion), anger, and anxiety (both negative, activating emotions).

Hypothesis 2: Teachers' instructional behavior relates to students' discrete emotions in class.

Our second aim is to replicate prior research (Frenzel, Goetz, Lüdtke, et al., 2009; Goetz, Lüdtke, et al., 2013), which suggested that teachers' instructional behavior was related to students' emotions. Specifically, we built on previous research by focusing on facets of instructional behavior that were directly linked to control and value appraisals, namely understandability and lesson structure (control induction), and practical relevance (value induction), as these are important appraisals of students' emotions (see Pekrun, 2006).

Hypothesis 3: Teachers' emotions are significantly related to students' emotions in class, above and beyond teachers' instructional behavior.

Our third aim is to demonstrate that both teachers' instructional behavior and their emotions are important predictors of student outcomes. Previous research has shown that these constructs are related as teachers' emotions have an impact on their instructional behavior and it is assumed that teachers' instructional behavior mediates the crossover between teachers' and students' emotions. However, as emotions also directly cross over between interaction partners, we expect a direct relationship between teachers' emotions and students' emotions not accounted for by teachers' instructional behavior, i.e., teachers' emotions explain incremental variance in students' emotions.

Method

Sample

We conducted our study with a convenience sample drawn from eight different schools from the upper track (Gymnasium*)* in the German-speaking parts of Switzerland. Data was assessed in 44 different grade 9-classes in which three to four students per class were randomly selected to participate in our experience sampling study. Our sample consisted of 149 students (55% female) with a mean age of 15.63 years (SD = 0.62). Data were collected with handheld devices (iPod Touch 4G) over a period of 10 school days in the second term of the academic year.

Data Collection

Demographics were assessed prior to employing the experience sampling technique with conventional paper-pencil questionnaires. Participants were then equipped with iPod Touch devices programmed with experience-sampling-software (iDialog Pad, see Kubiak & Krog, 2012) and prompted to record their immediate emotional experiences in class, their perceptions of their teachers' emotions and instructional behavior over the course of two consecutive weeks (M = 9.53 school days, SD = 2.12). Data assessment combined event-based and random sampling: Students were instructed to activate the device at the beginning of their lessons (i.e., event-sampling) in four different subject domains (German, English, French and mathematics) with each lesson lasting 45 minutes. The device was programmed to randomly signal once within the next 10-35 minutes (i.e., random-sampling) to present a questionnaire that asked students to report on their momentary emotions as well as perceived teacher's emotions, and teacher's instructional behavior. If students did not respond within four minutes to the signal, the device timed out and recorded as a missed signal. Questions were displayed one at a time and it took approximately two minutes to complete the entire questionnaire. Filter questions were used to ensure that students only reported on their teachers' emotions and instructional behavior in class situations in which the teacher had an active part and actual teaching took place (e.g., students' did not answer questions regarding their teacher when the teacher was absent or when another student had an oral presentation). Students activated their devices in 2890 lessons and completed a total of 2668 questionnaires (7.6% missed signals). In 431 (16.4%) of these questionnaires, students' reported classroom situations in which no evaluation of teachers' instructional behavior or emotions was possible (see examples above), resulting in a final sample of 2230 questionnaires.

Measures

To avoid overly intrusive state-based questionnaires (Goetz et al., 2010), single-items were used, a procedure frequently adopted in experience-sampling studies in academic contexts (e.g., Goetz, Bieg, et al., 2013; Nett & Goetz, 2011; Schimmack, 2003; Tong et al., 2007). Students' *emotions* were assessed with three slightly modified items from the Academic Emotions Questionnaire (Pekrun, Goetz, & Frenzel, 2005). The following items were employed: "I am angry at this moment" for the assessment of anger; "I am anxious at this moment" for the assessment of student's anxiety, and "I am happy at this moment" for the assessment of student's enjoyment (see Goetz, Bieg, et al., 2013; Goetz, Lüdtke, et al., 2013 for a similar assesment).

A parallel item wording was used to assess *perceived teacher emotions*. The following items were employed: "My teacher is angry at this moment" for perceived teachers' anger; "My teacher is tense and nervous at this moment" for perceived teachers' anxiety and "My teacher is happy at this moment". All emotion items were rated on a 5-point Likert scale ranging from (1) *not at all* to (5) *very strongly*.

Teachers' instructional behavior was measured with selected items from scales developed for the PALMA Project (Project for the Analysis of Learning and Achievement in Mathematics, see Pekrun et al., 2007) and from the Inventory of Perceived Study Environment (Konings, Brand-Gruwel, van Merrienboer, & Broers, 2008). Three items that focused on value-induction ("At the moment, I can see the practical relevance of the subject matter") and control-induction ("At the moment, my teacher explains things in a comprehensible way" and "At the moment, I understand the aims and goals of this lesson") were used to assess teachers' instructional behavior. These items were combined to make a three-item scale, which yielded acceptable internal consistency ($\alpha = .70$). Items were rated on a 5-point Likert scale ranging from (1) *not true at all* to (5) *absolutely true*.

To account for the possibility that mood influences the way students perceive the emotions of their teachers, we used the control variable *mood before class* in all statistical analyses. Moods can be distinguished from emotions as moods are more diffuse, longer lasting, and unfocused affective states, whereas emotions are discrete and tend to have a concrete focus or are directed toward a particular "object" (see e.g. Morris & Schnurr, 1989; Scherer, 2005; Schutz, Hong, Cross, & Osbon, 2006). We assessed the basic dimension of pleasant-unpleasant mood with a slightly modified item drawn from the *adapted short version of the Multidimensional Mood Questionnaire* (Crayen, Eid, Lischetzke, Courvoisier, & Vermunt, 2012). Students indicated their mood by responding to a 9-point bipolar item with the anchors "bad mood" and "good mood". Students were prompted to indicate the mood that they were experiencing when they activated their devices before a lesson started.

In addition to controlling for mood before class, we also controlled for possible differences between *subject domains* in all analyses by examining whether results are consistent across the four subject domains in which students filled out the questionnaires. Students indicated the subject domain when they activated their device at the beginning of the lesson (1 = German, 2 = English, 3 = French, 4 = mathematics).

Statistical Analyses

Given that our data represents a three-level structure (see Figure 1) in which measurements at certain assessment points (Level-1: $N = 2230$) are nested within persons (Level-2: $N = 149$), who are nested within classes (Level-3: $N = 44$), multilevel analyses were conducted. To test our hypotheses, we calculated random regression coefficient models with HLM 6.06 software (Raudenbush, Bryk, Cheong, & Congdon, 2004). These models estimate variance at different levels of observations (in this case, within students, between students, and between classes) and account for the non-independence of these observations. HLM output only produces unstandardized coefficients, however by *z*-standardizing all variables prior to the analyses, these coefficients were adjusted to correspond to beta weights (Raudenbush et al., 2004).

In our analyses, we started with a null-model (also called an unconditional model or an intercept-only model) for each dependent measure (students' anger, anxiety, and enjoyment). That is, the intercept is the only predictor and there are no other predictors at level-1 (intrapersonal; situational variables), level-2 (interpersonal; personal attributes), or level-3 (between classes). In addition to providing a baseline model with which subsequent models can be compared, this analysis also offers information on the proportion of variance for the outcome variable at each of the levels.

In the next step (Model 1) we entered our level-1 control variables (mood before class and subject domain) as predictors for each model. Since subject domain was not a continuous variable, we constructed three dummy variables for English, German and French, with mathematics representing the reference domain (e.g., for dummy English: mathematics = 0, English = 1, German = 0, French = 0). This procedure makes it possible to detect subject domain differences in intercepts. Due to the coding of the dummy variables, the intercepts now refer to the reference domain (i.e., mathematics) and indicates to what degree the reference domains differs from the overall mean (i.e., zero since our outcome variables were *z*-standardized prior to the analysis) and whether this difference is significant. The slopes of the three subject dummy variables show the degree to which the intercept differs from the reference domain. Since our analyses focused on effects within person, *mood before class* was entered group-mean centered into the model (that is, for each student on his or her mean), because our analyses focus on effects within persons (for more information on centering see Snijders & Bosker, 2012, chapter 5).

To test the first hypothesis (i.e., that teachers' and students' emotions are significantly related), we added perceived teachers' emotions, group-mean centered to the model (Model 2a). To control for domain-related differences in slopes (i.e., structural differences in the relationship between predictor and outcome variable), three interaction terms were built between the independent variable (perceived teachers' enjoyment, anger, and anxiety) and the three dummy variables (German, English, and French) for each model (for a similar methodological procedure see Goetz, Lüdtke, et al., 2013). Interaction terms were created by multiplying group-mean centered factors with their respective dummy variables and were not re-centered when entered into the model.

The same procedure was used to analyze the second hypothesis (i.e., that teachers' instructional behavior and students' emotions are significantly related). To control for domain-related differences in slopes, we added teachers' instructional behavior as a predictor to Model 1 and entered three interaction terms (e.g., instructional behavior × subject domain), which resulted in Model 2b.

To test the third hypothesis (i.e., that teachers' emotions are significantly related to students' emotions in class, above and beyond teachers' instructional behavior) a third model (Model 3) was built. This model consists of the variables included in Model 2b with the addition of perceived teachers' emotions and the three subject domain interaction terms.

We assessed model improvement with deviance tests, a common method employed in multilevel modeling (e.g. Demerouti, Bakker, Sonnentag, & Fullagar, 2011; Neff et al., 2012; Tschan, Rochat, & Zapf, 2005). This test compares the difference between the likelihood ratios of the two different models (i.e., the improvement of one model compared to another model). This deviance statistic has an approximate chi-square distribution with degrees of freedom corresponding to the number of parameters estimated in the models (see Raudenbusch & Bryk, 2002).

Results

Preliminary Analyses:

Table 1 presents the means, standard deviations, and within-person-correlations among our study variables. Means and standard deviations were averaged across all subjects and measurement points (N = 2230)[1]. Within-person correlations (state-correlations) were calculated by using variables that were z-standardized separately for each participant. Enjoyment was the emotion experienced most intensely by study participants during class (M = 2.85, SD = 1.19), followed by anger (M = 1.83, SD = 1.16) and anxiety (M = 1.45, SD = 0.93). The same pattern was found for perceived teachers' enjoyment (M = 3.01, SD = 1.10), anger (M = 1.82, SD = 1.06) and for anxiety (M = 1.76, SD = 0.98). The mean student mood before entering the class was 6.46 (SD = 1.19), indicating a slightly positive mood (1 = negative mood, 5 = neutral, 9 = positive mood). Within-person correlations also showed that mood before class was significantly related to perceived teachers' enjoyment (r = .14, p < .001), teachers' anger (r = -.06, p < .05) and teachers' instructional behavior (r = 16, p < .001) and thus, supports our rational to include it as a control variable in our main analyses.

In our null models (see the first column in Tables 2 to 4) 20.08% of the variance for students' anger was attributable to between person variations, 79.91% was attributable to between lesson variations, and there was almost no variance on the between class level (0.01%). Similar results were obtained for enjoyment (77.93% on level-1, 22.04% on level-2, and 0.02% on level-3). In slight contrast, there was more variance on the between person-level and less variance on the within-person level for students' anxiety (73.61% on level-1, 26.38% on level-2, and 0.01% on level-3) than for anger and enjoyment. Since it is possible that the high amount of variance on level-1 is attributable to between-domain differences in emotional experiences (see e.g., Goetz, Frenzel, Pekrun, Hall, & Lüdtke, 2007), we refer to Model 1 in our analyses. By comparing the null model with Model 1, where subject domains and mood before class are controlled, it shows that the subject domain is a significant

[1] Descriptive statistics for each subject domain can be found in the Appendix.

predictor of students' emotions in class, but that the highest proportion of variance remains on level-1. Overall, these results suggest that the majority of variance in discrete emotions is on the within-person-level (i.e., between school lessons). Students' emotions in class varied between lessons even when the subject domain was taken into account. A very small proportion of variance was attributable to the class-level (level-3), which indicates that it is less important to include this level in our analyses. Nevertheless, we conducted our analyses with the three-level structure as it is advisable to keep models maximal (Barr, Levy, Scheepers, & Tily, 2013).

Test of Hypotheses

The first hypothesis postulated that teachers' and students' emotions within one lesson are significantly related. Our analyses demonstrated that teachers' emotions were significantly related to students' emotions, which was evident by regression weights in Model 2a being significant for all three students' emotions. This indicates that student and teacher emotions were substantially related, even when controlling for students' mood before class and the subject domain. The strongest relationship was found for enjoyment ($b = .27$, $t = 9.25$, $p < .001$), then anger ($b = .22$, $p < .001$), and then anxiety ($b = .12$ $p < .05$). All interaction terms (i.e., perceived teacher emotions × subject domain) were non-significant, which indicates that the structural relationship between teacher and student emotions is consistent across subject domains. The difference in residual variance between Model 2a and Model 1 suggests that the model fit significantly increased when taking teachers' emotions into account, which clearly supports our first hypothesis.

The second hypothesis stated that teachers' instructional behavior is related to students' emotions within a lesson. This hypothesis was tested using the same approach used to verify the first hypothesis, namely by comparing Model 1 with a model in which perceived teachers' instructional behavior and the three interaction terms between instructional behavior and subject domains were entered as additional predictors (Model 2b). Results indicate that teachers' instructional behavior was related to students' anger (b = -.10, p < .05) and students' enjoyment (b = .30, p < .001) but unrelated to students' anxiety (b = -.05, n.s.). Furthermore, except for the relationship between teachers' instructional behavior in mathematics and French, and students' enjoyment (b = -.17, p < .05), all interaction terms were non-significant. There was no consistent pattern for the structural differences between mathematics and French found across all assessed emotions. Deviance tests showed that Model 2b had a better fit as compared to Model 1 for all three emotions, providing support for the second hypothesis.

The third hypothesis stated that teachers' emotions are related to students' emotions above and beyond teachers' instructional behavior. This hypothesis was tested by regressing teachers' emotions, instructional behavior, and the control variables on students' emotions (Model 3) and comparing this model to Model 2b (instructional behavior and control variables as predictors). With this analysis we examined if teachers' emotions explained incremental variance and compared the regression weights between teachers' emotions and teachers' instructional behavior. The regression coefficients for teachers' emotions remained significant for students' enjoyment and anger. In fact, the regression coefficient for teachers' enjoyment was of comparable size to the coefficient for teachers' instructional behavior (b=.24 / b=.23) whereas the regression coefficient for teachers' anger was slightly greater (b=.21/b=-.11). This suggests that emotions also directly crossover in class and are not fully mediated by teachers' instructional behavior. Students' anxiety in class was not significantly predicted by teachers' anger or instructional behavior. However, when comparing Model 3 and Model 2b, model fit significantly increased for every emotion. As such, these results provide support for the third hypothesis.

Discussion

The present study focused on the crossover of discrete emotions (enjoyment, anger, and anxiety) in an academic context and tapped a largely unexplored field of research. In line with our hypotheses, our results indicate that perceived teachers' emotions and students' own emotions are related. Furthermore, teachers' and students' emotions are significantly related, above and beyond teachers' instructional behavior. In particular, teachers' emotions explain incremental variance in students' emotions, which can be explained by direct unconscious crossover processes such as emotional contagion or consciously through empathy. It is also possible that other mediating variables are important for crossover processes of discrete emotions such as teachers' immediacy (McCroskey, Richmond, Sallinen, & Fayer, 1995) or teacher enthusiasm (Frenzel, Goetz, Lüdtke, et al., 2009). Our study only focused on instructional behavior that induces control and value in students.

Our results are in line with previous research on emotional crossover processes between interaction partners (e.g., Barsade, 2002; Kelly & Barsade, 2001; Mottet & Beebe, 2000) but to our knowledge, this is the first time that this phenomenon is tested in an academic context with a situational, intraindividual approach. Emotional experiences involve person-environmental transactions and should therefore be studied in the authentic setting where they occur (Schutz et al., 2006), in this case the classroom. Moreover, this is the first time that teachers' emotions and instructional behavior, and their influence on students' emotions are contrasted in one study. Clearly our study documents the "power of emotions" in academic contexts. Given that "in the first two decades of most people's lives, educational settings are one of the most important sources of affective experience" (Fiedler & Beier, in press), it is especially important to identify possible sources of emotional experiences in the classroom.

The structural relationships between teachers and students emotions were consistent across subject domains, indicating that emotional crossover effects are not situation specific but rather universal processes. This finding is in line with the basic premise of emotional contagion theory, that suggests that emotional contagion is a rather unconscious automatic process that should occur in all human interactions (Hatfield et al., 1994). However, this assumption has not been empirically tested in an academic setting. Our results suggested that although students' mean level of emotions differed between subject domains (e.g., students experience more anger in mathematics as compared to the other three subject domains), the strength of the relationship between teachers' and students' emotions do not differ.

Our study also supports paths of the *model of reciprocal causation between teachers' emotions, instructional behavior, and student outcomes* proposed by Frenzel and colleagues (Frenzel, Goetz, Stephens, et al., 2009). The results show that students' enjoyment and students' anger are related to teachers' instructional behavior. In accordance with previous theoretical (Pekrun, 2006) and empirical work (Goetz, Lüdtke, et al., 2013), this result supports the claim that instructional behavior that promotes control and value among students, impacts students' emotions.

One unanticipated finding was that teachers' instructional behavior did not predict students' anxiety. A possible explanation for this result is that the anxiety reported was low in intensity and had little variance (M = 1.45, SD = 0.93 on a 5-point Likert Scale), which reduced statistical power. Since students filled out the questionnaire during a normal lesson rather than while taking a test, anxiety was apparently not an especially intense or frequent emotion reported. Although regression coefficients were non-significant, they were in the expected direction and model fit improved when instructional behavior was taken into account.

The strength of the relationship between teachers’ instructional behavior and students’ emotions did not differ between subject domains, with the exception of teachers’ and students’ enjoyment in French as compared to mathematics. However, as there is not a systematic pattern, when comparing these two domains, it is hard to interpret this finding. Nevertheless, in general, our results support the assumption that the structural relationships proposed by the control-value theory of achievement emotions are universal across domains (Pekrun, 2006). Furthermore these relationships are in line with the already described empirical study by Goetz, Lüdtke and colleagues (2013) that also found very similar relationships between characteristics of teaching and students’ emotions across the assessed academic domains.

Furthermore, results also demonstrate that the majority of variance in students’ emotions in class was on the within-person-level (level-1), even after taking subject domain into account. That is, students’ variations in emotions are highly dependent on situational factors at the lesson-to-lesson level which suggests that emotions are in fact highly dynamic and situation-specif. Our study shows that teachers’ emotions and their instructional behavior are important situational factors that predict students’ emotions in class. However, other factors such as day of the week, time of the day, or the emotions of peers likely play important roles too and thus further investigations are required. From a practical perspective, it can be encouraging for teachers that variance in students’ emotions in class is highly attributable to lesson-to-lesson variables. Consequently, teachers can influence their students’ emotions by modeling appropriate emotions, and by creating clear and valuable lessons. Emotions are not stable (e.g., a student is not always bored) but vary from lesson-to-lesson.

However, it also means that teachers must take special care to reach their students in every single lesson. For example, since academic emotions are highly situational, even a student who enjoys school, reports positive trait-emotions, and has a high academic self-concept can be negatively influenced by an angry teacher who gives poor examples.

Another important finding from our study is that mood before entering the classroom is significantly related to almost all other study variables. That is, one's mood does not only persist and influence one's emotions in class, but it might also influence how the quality of the lesson and the emotions of others are perceived. An implication is that teachers should be especially conscious of their students' mood at the beginning of the lesson and if possible, they should seek to positively influence and avoid negatively influencing their students' mood. This might entail simply saving unfavorable feedback for the end of the class (i.e., returning graded assignments and tests at the end of the lesson). Similarly, students and teachers can foster their own good mood before class by actively invoking thoughts, images, and memories that are connected with positive experiences (e.g. Frenzel & Stephens, 2013), or by deliberately beginning the lesson by expressing positive emotions, which should impact the emotional climate in class. Alternatively, it is advisable to start the lesson with a little game or a ritual to calm or energize the class rather than starting the lesson straight away or handling organizational issues.

Limitations and future research

Although the results of this study contribute to the crossover theory and offer practical guidelines for teachers and students, there are a few drawbacks that must be addressed. First it should be noted that the present study falls victim to the common-method bias (e.g., Podsakoff, MacKenzie, Lee, & Podsakoff, 2003) as student and teacher emotions were both assessed from student self-reports. It is argued that this type of data collection yields inflated correlations and is one of the main sources of measurement error. Nevertheless, some researchers argue that this criticism is overstated (e.g., Crampton & Wagner, 1994; McCroskey et al., 1995; Spector, 2006). Moreover we adopted a situational approach in which emotions were measured close to the emotional episode, a method used for emotional reports that are less biased than more conventional trait-based assessments (Härtel & Page, 2009). As such, future research should use reports from both sources – teachers and students.

A related limitation of this study is that *perceived* teacher emotions were measured. There is little research on the reliability and validity of the assessment of affective states of others and consequently it is unclear if this approach is a suitable indicator of teachers' *actual* emotions. Having this potential shortcoming in mind, we deliberately chose to focus on distinct *basic emotions* that are comparably easy to detect via facial expression (e.g., Ortony & Turner, 1990). Therefore, it is reasonable to assume that students are capable of accurately recognizing and reporting these emotional expressions. Nevertheless, teachers' emotional expressions can differ from their actual emotions as prior research suggests that teachers frequently regulate their emotions (e.g., Sutton, 2004). For the direct emotional contagion process to occur it is important that emotions are visually detectible, as mimics and gestures are imitated. This suggests that emotion regulation among teachers should not impact this type of crossover effect when emotions are assessed according to perceived teacher emotions. In contrast, for the indirect crossover process to occur, which involves for example instructional behavior, teachers' actual emotions are important. If a teacher shows enjoyment by smiling, but feels anxious on the inside, his or her instructional behavior does not necessarily benefit as thoughts and action repertoires are not broadened if there are no real positive emotions (see Fredrickson, 2001 for a detailed decription how positive emotions can enhance one's resources). Consequently, future research should investigate the impact of factitious emotional displays on the emotions of an interaction partner's actual emotions. This call for inquiry echoes that proposed in the teacher enthusiasm literature (e.g., Frenzel, Goetz, Lüdtke, et al., 2009). As such, multi-methodology approaches to measure emotions (e.g., physiological measures, video recordings of nonverbal expressions) could be especially enriching.

Finally, our study design does not allow for causal interpretations of the relationships. Circular relationships are both likely and expected in this context (Frenzel, Goetz, Stephens, et al., 2009). Teachers' emotions might be influenced by students' emotions and also by their instructional behavior (e.g., a teacher would likely experience pride when they notice that their students understand their explanations of complex content matter). For the present study we took the perspective of the student and decided to focus on the influences from teachers' emotions and instructional behavior on students' emotions. This choice was based on the practical difficulties of employing experience sampling methods with teachers, and our desire to minimize the intrusiveness of this study while maintaining a high level of ecological validity. Nevertheless, reciprocal relationships should be investigated in future studies using teachers' and students reports on their emotional states.

Conclusion

The findings from our study indicate that teachers' and students' emotions in class are closely related and that teachers' emotions explain incremental variance in students' emotions above and beyond their instructional behavior. Teachers need to acknowledge the power of their emotions and that teaching involves more than just instructional behavior. The emotions that teachers bring to the classroom have important effects on their students' emotions. Many teachers spend a substantial amount of time preparing their lessons and sometimes they forget about their own well-being, which is evident by the high burnout rates frequently reported in the teaching profession (e.g., Bakker & Schaufeli, 2000; Chang, 2009; Evers, Tomic, & Brouwers, 2004). Our study indicates that teachers can influence students' emotions at the lessons-to-lesson level. Their own emotions play a major role and should not be disregarded in the daily and often busy teaching profession. Teachers should therefore care about their emotions, not only for their students' sake, but also because it is important for themselves.

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Table 1

Means, standard deviations, and within-subject correlations among the study variables

	Variable	*M*	*SD*	1	2	3	4	5	6	7
1	Positive Mood before Class	6.46	1.96							
2	Teacher Anger	1.82	1.06	-.06*						
3	Teacher Anxiety	1.76	0.98	-.03	.34***					
4	Teacher Enjoyment	3.01	1.10	.14***	-.29***	-.23***				
5	Instructional Behavior	3.14	0.89	.16***	-.12***	-.15***	.29***			
6	Student Anger	1.83	1.16	-.21***	.22***	.15***	-.17***	-.17***		
7	Student Anxiety	1.45	0.93	-.08*	.12***	.12***	-.09***	-.07*	.12***	
8	Student Enjoyment	2.85	1.19	.30***	-.08*	-.04	.26***	.26***	-.08**	-.10***

Note. Correlations are intraindividual state-level correlations (*N* = 2230). * p < .05; ** p < .01; *** p < .001

Table 2

Multilevel estimates for models predicting students' anger in class

	Null Model		Model 1			Model 2a			Model 2b			Model 3		
Variable	Estimate	SE	Estimate	*SE*	*t*	Estimate	*SE*	*t*	Estimate	*SE*	*t*	Estimate	*SE*	*t*
Intercept	0.03	0.04	0.20	0.07	3.10**	0.18	0.06	2.97**	0.13	0.06	2.05*	0.09	0.07	1.73
Slope *Teacher Anger*						0.22	0.06	3.86***				0.21	0.06	3.64***
Slope *Instr.Behavior*									-0.10	0.05	-2.00*	-0.11	0.05	-2.05*
Slope Control variables *Pos. Mood Before Class*			-0.20	0.03	-7.25***	-0.19	0.03	-6.51***	-0.19	0.03	-6.79***	-0.18	0.06	-5.88***
Dummies: German			-0.30	0.06	-4.79***	-0.26	0.06	-4.07***	-0.22	0.06	-3.88***	-0.17	0.05	-3.60**
English			-0.24	0.07	-3.58**	-0.22	0.07	-3.21**	-0.14	0.07	-2.03*	-0.12	0.07	-1.79
French			-0.18	0.06	-2.94**	-0.18	0.06	-3.14**	-0.10	0.05	-1.86	-0.09	0.05	-1.71
Interactions: *German x Teacher Anger*						-0.12	0.08	-1.54				-0.13	0.08	-1.73
English x Teacher Anger						0.06	0.07	0.78				0.05	0.07	0.68
French x Teacher Anger						0.02	0.07	0.31				0.01	0.06	0.17
German x Instr. Behavior									-0.04	0.07	-0.65	-0.06	0.07	-0.94
English x Instr. Behavior									0.00	0.09	0.06	0.06	0.08	0.46
French x Instr. Behavior									-0.05	0.08	-0.61	0.05	0.08	0.55
Random Effects	Variance (*SD*)	Pro-portion	Variance	*SD*		Variance	*SD*		Variance	*SD*		Variance	*SD*	
Level-1(σ^2)	0.81 (0.89)	79.91%	0.70	0.83		0.59	0.76		0.64	0.80		0.53	0.72	
Level-2 (τ_{00})	0.20 (0.45)	20.08%	0.36	0.60		0.36	0.60		0.37	0.60		0.35	0.59	
Level 3 (u_{00})	0.00 (0.01)	0.01%	0.04	0.21		0.03	0.18		0.03	0.17		0.02	0.13	
-2 x log	7243.37		7007.02			5679.46			6734.61			5513.82		
Δ-2 x log			236.35***	df = 32		1327.56***	df = 64		272.41***	df = 64		1220.79***	df = 132	

Note. The intercept in Model 1 to Model 3 refers to the reference subject domain (i.e. mathematics). Predictor and outcome variables were z-standardized prior to analysis to obtain standardized regression weights. Teacher anger, instructional behavior and positive mood before class were group-mean centered, dummies were uncentered and the interaction terms were calculated with the group-mean centered predictors (teacher anxiety / instructional behavior) and the respective dummies and (not re-centered afterwards). Δ-2 x log refers to model improvements as compared to the previous model (Model 1-Null Model; Model 2a-Model 1; Model 2b-Model 1; Model 3-Model 2b); * $p < .05$ ** $p < .01$ *** $p < .001$.

Table 3

Multilevel estimates for models predicting students' anxiety in class

	Null Model		Model 1			Model 2a			Model 2b			Model 3		
Variable	Estimate	SE	Estimate	*SE*	*t*	Estimate	*SE*	*t*	Estimate	*SE*	*t*	Estimate	*SE*	*t*
Intercept	0.00	0.04	0.09	0.06	1.36	0.08	0.06	1.30	0.04	0.06	0.65	0.02	0.05	0.36
Slope *Teacher Anxiety*						0.12	0.05	2.52*				0.08	0.04	1.82
Slope *Instr.Behavior*									-0.05	0.06	-0.86	-0.07	0.06	-1.23
Slope Control variables *Pos. Mood Before Class*			-0.06	0.03	-2.30*	-0.06	0.033	-2.01*	-0.06	0.03	-2.15*	-0.04	0.03	-1.44
Dummies: German			-0.14	0.06	-2.27*	-0.12	0.07	-1.88	-0.09	0.06	-1.49	-0.05	0.06	-0.99
English			-0.09	0.05	-1.72	-0.13	0.05	-2.33*	-0.04	0.05	-0.74	-0.03	0.06	0.52
French			-0.08	0.06	-1.41	-0.08	0.06	-1.21	-0.06	0.06	-0.60	-0.02	0.05	-0.38
Interactions: *German x Teacher Anxiety*						0.03	0.07	0.44				0.09	0.07	1.14
English x Teacher Anxiety						-0.07	0.08	-0.92				-0.03	0.07	-0.45
French x Teacher Anxiety						0.08	0.08	0.92				-0.11	0.09	1.33
German x Instr. Behavior									0.00	0.07	0.06	0.08	0.07	1.11
English x Instr. Behavior									-0.05	0.08	-0.65	-0.07	0.08	-0.96
French x Instr. Behavior									0.01	0.07	0.08	0.03	0.07	0.39
Random Effects	Variance (*SD*)	Pro-portion	Variance	*SD*		Variance	*SD*		Variance	*SD*		Variance	*SD*	
Level-1(σ^2)	0.74 (0.86)	73.61%	0.65	0.80		0.53	0.73		0.57	0.75		0.44	0.66	
Level-2 (τ_{00})	0.27 (0.52)	26.38%	0.46	0.68		0.42	0.65		0.38	0.62		0.35	0.59	
Level 3 (u_{00})	0.00 (0.01)	0.00%	0.02	0.16		0.03	0.17		0.04	0.20		0.03	0.17	
-2 x log	7043.86		6876.47			5567.24			6528.83			5295.48		
Δ-2 x log			167.39***	df = 32		1309.23***	df = 64		347.63***	df = 64		1580.99***	df= 132	

Note. The intercept in Model 1 to Model 3 refers to the reference subject domain (i.e. mathematics). Predictor and outcome variables were z-standardized prior to analysis to obtain standardized regression weights. Teacher anger, instructional behavior and positive mood before class were group-mean centered, dummies were uncentered and the interaction terms were calculated with the group-mean centered predictors (teacher anxiety / instructional behavior) and the respective dummies and (not re-centered afterwards). Δ-2 x log refers to model improvements as compared to the previous model (Model 1-Null Model; Model 2a-Model 1; Model 2b-Model 1; Model 3-Model 2b); * $p < .05$ ** $p < .01$ *** $p < .001$.

Table 4

Multilevel estimates for models predicting students' enjoyment in class

	Null Model		Model 1			Model 2a			Model 2b			Model 3		
Variable	Estimate	SE	Estimate	*SE*	*t*	Estimate	*SE*	*t*	Estimate	*SE*	*t*	Estimate	*SE*	*t*
Intercept	0.03	0.04	-0.10	0.06	-1.81	-0.07	0.06	-1.18	0.01	0.05	0.14	0.01	0.06	-0.17
Slope *Teacher Enjoyment*						0.27	0.05	5.60***				0.24	0.05	5.28***
Slope *Instr.Behavior*									0.30	0.04	7.45***	0.23	0.05	5.12***
Slope Control variables *Pos. Mood Before Class*			0.28	0.02	11.86***	0.27	0.02	10.90***	0.26	0.02	11.34***	0.26	0.02	11.13***
Dummies: German			0.16	0.05	3.22**	0.07	0.05	1.33	0.03	0.05	0.56	-0.01	0.05	-0.19
English			0.16	0.06	2.69**	0.08	0.06	1.42	-0.05	0.06	-0.93	-0.07	0.06	-1.12
French			0.08	0.06	1.41	0.05	0.06	0.87	-0.07	0.05	-1.34	-0.05	0.05	-0.97
Interactions: *German x Teacher Enjoy.*						-0.09	0.06	-1.67				-0.11	0.06	-1.84
English x Teacher Enjoy.						-0.03	0.06	-0.42				-0.05	0.06	-0.96
French x Teacher Enjoy.						-0.03	0.05	-0.57				-0.00	0.05	-0.08
German x Instr. Behavior									-0.11	0.07	-1.61	-0.07	0.08	-0.98
English x Instr. Behavior									-0.05	0.07	-0.70	-0.04	0.07	-0.57
French x Instr. Behavior									-0.17	0.07	-2.45*	-0.17	0.09	-2.00
Random Effects	Variance (*SD*)	Pro-portion	Variance	*SD*		Variance	*SD*		Variance	*SD*		Variance	*SD*	
Level-1(σ^2)	0.78 (0.88)	77.93%	0.65	0.28		0.58	0.76		0.59	0.77		0.52	0.72	
Level-2 (τ_{00})	0.22 (0.47)	22.04%	0.28	0.52		0.24	0.48		0.22	0.47		0.21	0.46	
Level 3 (u_{00})	0.00 (0.01)	0.02%	0.01	0.12		0.02	0.15		0.02	0.14		0.03	0.18	
-2 x log	7156.49		6870.67			5601.157			6507.66			5404.14		
Δ-2 x log			285.82***	df = 32		1269.51***	df = 64		363.00***	df = 64		1103.52***	df= 132	

Note. The intercept in Model 1 to Model 3 refers to the reference subject domain (i.e. mathematics). Predictor and outcome variables were z-standardized prior to analysis to obtain standardized regression weights. Teacher anger, instructional behavior and positive mood before class were group-mean centered, dummies were uncentered and the interaction terms were calculated with the group-mean centered predictors (teacher anxiety / instructional behavior) and the respective dummies and (not re-centered afterwards). Δ-2 x log refers to model improvements as compared to the previous model (Model 1-Null Model; Model 2a-Model 1; Model 2b-Model 1; Model 3-Model 2b); * p < .05 ** p < .01 *** p < .001.

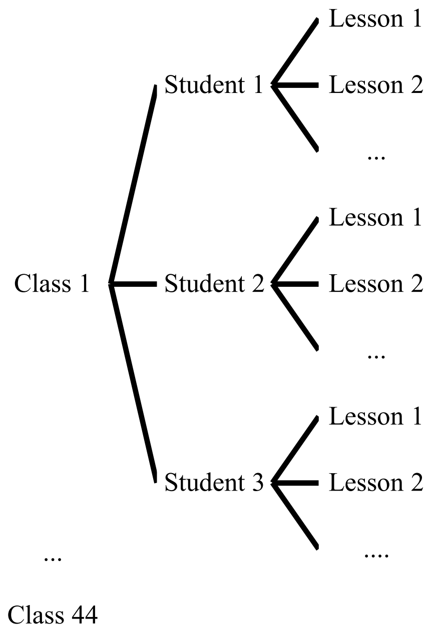

Fig. 1. Data Structure

Appendix A

Table 1

Descriptive statistics for study variables and academic domains

	Variable	*All*		German		English		French		Mathematics	
		M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
1	Positive Mood before Class	6.46	1.96	6.52	1.90	6.74	1.78	6.30	2.13	6.33	1.97
2	Teacher Anger	1.82	1.06	1.70	0.97	1.77	1.08	1.83	1.06	1.97	1.10
3	Teacher Anxiety	1.76	0.98	1.66	0.89	1.73	1.01	1.78	0.95	1.86	1.06
4	Teacher Enjoyment	3.01	1.10	3.20	1.04	3.14	1.13	2.92	1.11	2.82	1.08
5	Instructional Behavior	3.14	0.89	3.12	0.85	3.42	0.89	3.31	0.84	2.79	0.86
6	Student Anger	1.83	1.16	1.17	1.07	1.72	1.12	1.82	1.14	2.04	1.26
7	Student Anxiety	1.45	0.93	1.38	0.85	1.42	0.91	1.44	0.91	1.52	1.02
8	Student Enjoyment	2.85	1.19	2.91	1.16	2.99	1.19	2.82	1.20	2.73	1.20

Note. N (all) = 2230, *N* (German) = 551, *N* (English) = 508, *N* (French) = 551, *N* (mathematics) = 620